

Asset Integrity Management

Significant Issues

IRF Perspective

Stuart Pinks, Chief Safety Officer
Canada-Nova Scotia Offshore Petroleum Board
Halifax, Nova Scotia, Canada



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

December 5, 2007

Presentation Overview

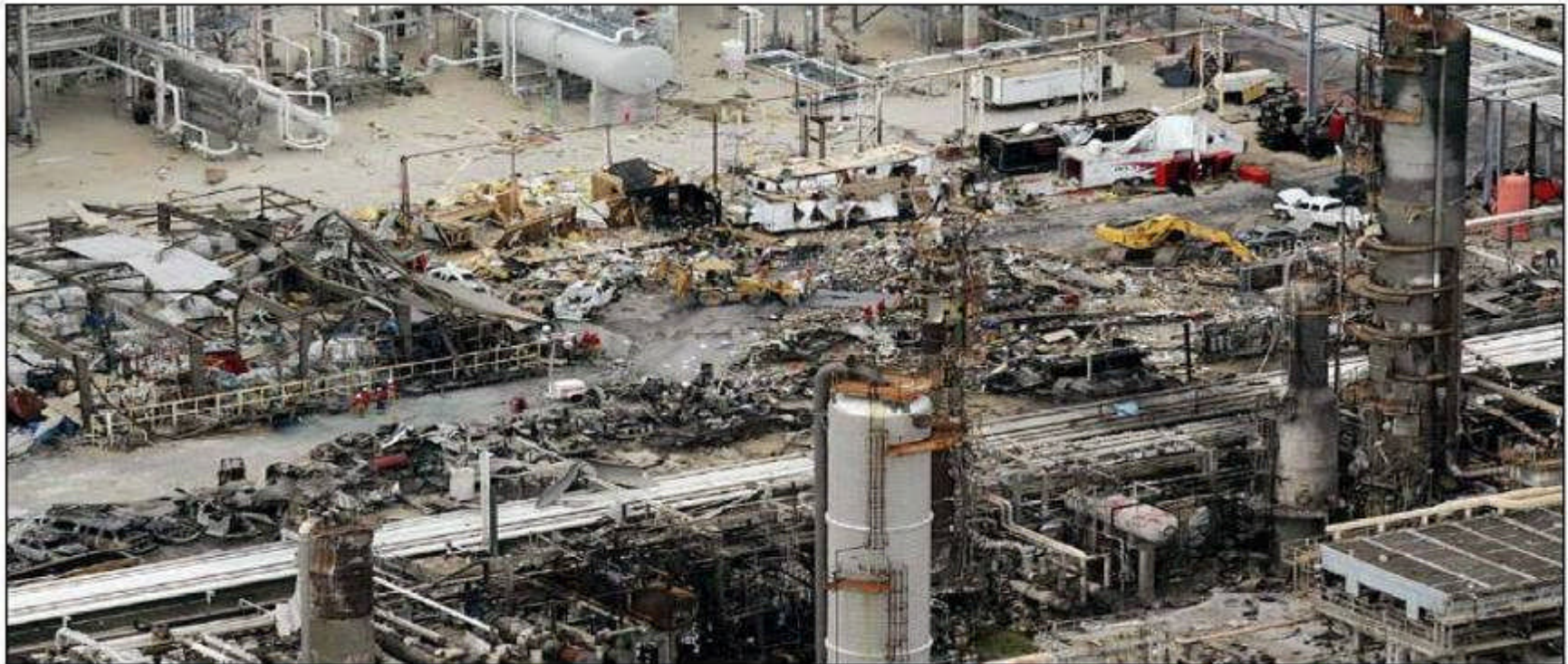


1. Process Safety
2. Life Extension of Aging Assets
3. Well Integrity
4. Marine/Platform or Rig Interfaces



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Part 1 - Process Safety



BP Texas City Refinery Explosion and Fire
(15 killed, 180 injured)



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Hazards

Personal or Occupational Health and Safety

Hazards

- Can give rise to incidents or accidents that primarily affect one individual worker for each occurrence

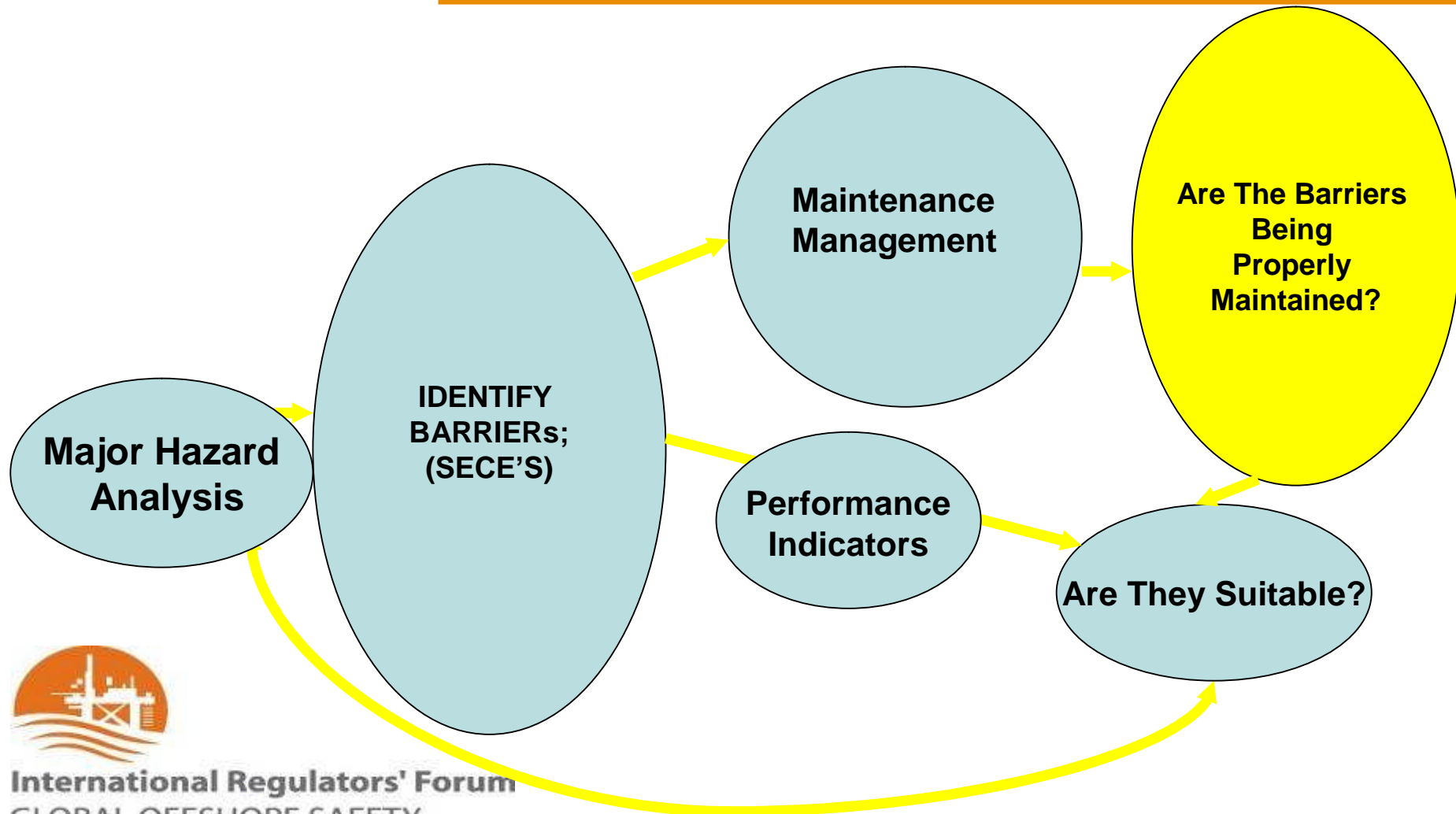
Process Safety Hazards

- Can give rise to major accidents that can have catastrophic effects and can result in multiple injuries and fatalities, as well as substantial economic, property and environmental damage



Process Safety Management

Major Hazard Analysis/Maintenance Loop



Process Safety Management System



An effective process
safety management
system measures
performance

***Key performance indicators must include
appropriate indicators of process safety
performance***



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Learning Points

Key areas requiring focus:

- Process Safety Culture / Process Safety Management System
- Competency assurance
- Definition / reporting of process safety performance indicators
- Maintenance strategy corresponds with risk of accidents / major accidents
 - Safety and Environmentally critical elements defined
 - Safety and environmental devices not bypassed during maintenance



Learning Points

- Maintenance items properly classified and prioritized:
 - Appropriately resourced
 - Deferral process properly defined
 - Timely supply of materials
 - Project work not prioritized over maintenance work

There is a need for long term investment strategies and decision making by senior management for maintenance of asset integrity.



Part 2 - Life Extension of Aging Installations



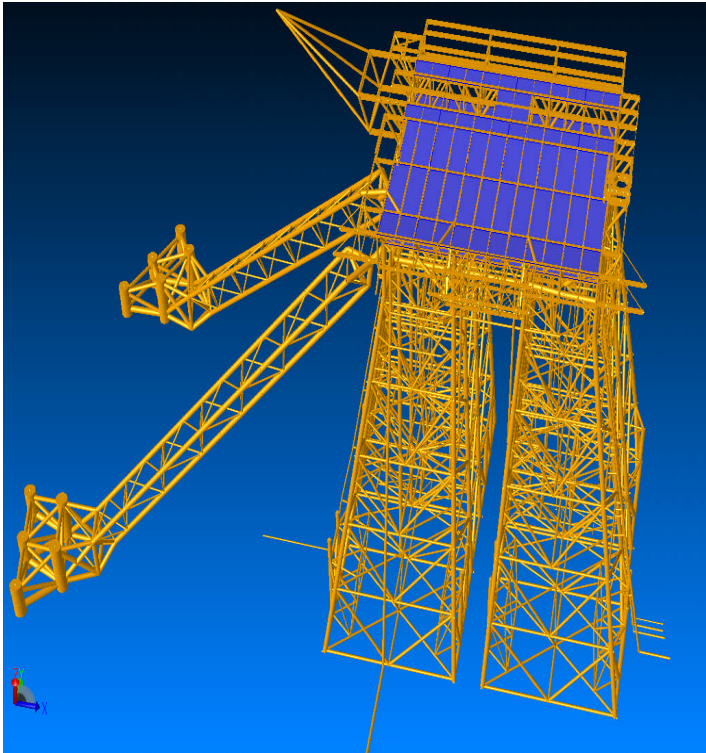
International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Elements of Aging that Affect Safety of Installations

- Fatigue
- Corrosion
- Geotechnical and Geological Hazards
- Accidental Damage
- Extreme Weather
- Modifications and Change of Use
- Marine Growth



Fatigue



- Cracking of welded structural components can have serious implications
- Cracking can occur much earlier or later than anticipated



Corrosion



- General hazard that must be monitored
- Need to assess
 - Effectiveness of sacrificial anodes
 - Coatings
 - Corrosion allowances
 - Corrosion under insulation



Geological and Geotechnical Hazards



Installation Foundation Hazards:

- Pile degradation / failure

Geological hazards:

- Subsidence and slope instability
- Earthquakes



Accidental Damage



- Ship Collision
- Dropped Objects
- Accumulated Damage; includes
 - Minor damage not repaired
 - Missed damage



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Extreme Weather



- Design to appropriate loading criterion
- Damage occurs primarily to:
 - Members and joints in steel sub-structure
 - Structural supports for risers
 - Topside structural supports
 - Equipment on lower deck



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Modifications and Change of Use



- Addition of new facilities
 - consideration of topside weight
- Change in purpose



Marine Growth



- Increases wave loading on a structure
- Impedes ability of FPSO to depart in emergency situation



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

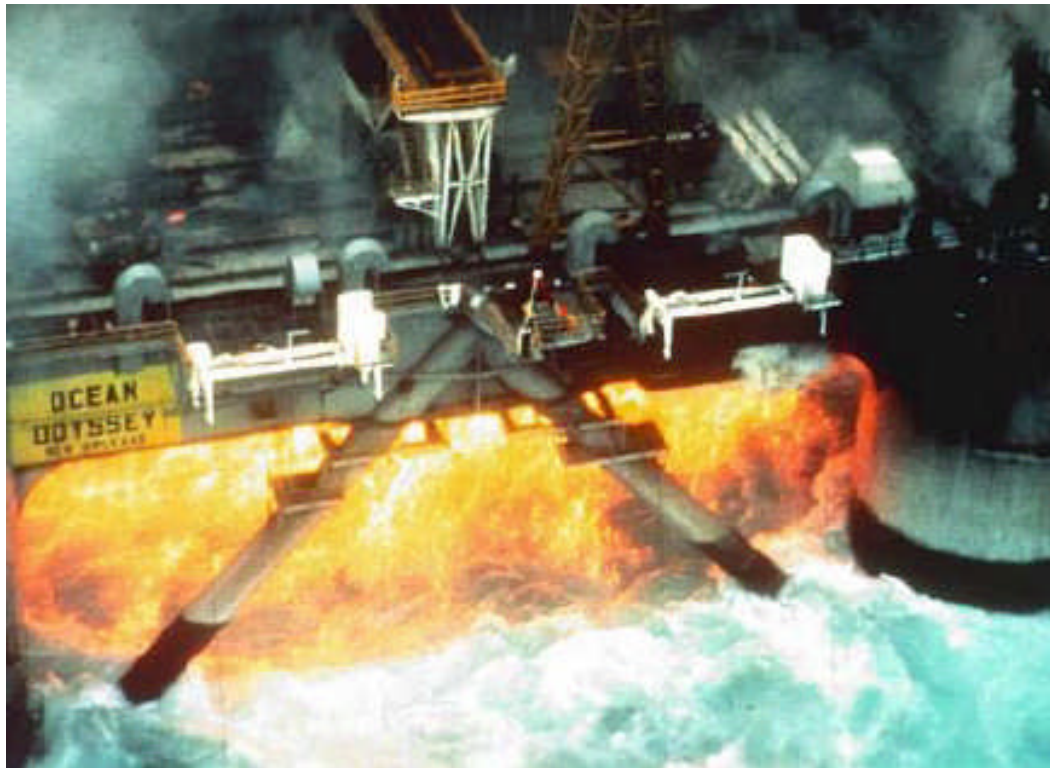
Learning Points

An approach to life extension may include these steps:

1. Define current anticipated operating life
2. Define extended operating life (based on field life and other factors)
3. Undertake a comprehensive safety review to confirm continued integrity
 - Assessment of records
 - Testing and inspection data
 - Check against modern codes and standards
 - Redundancy analysis
4. Identify shortfalls / implement improvements
5. Define ongoing inspection / maintenance strategy

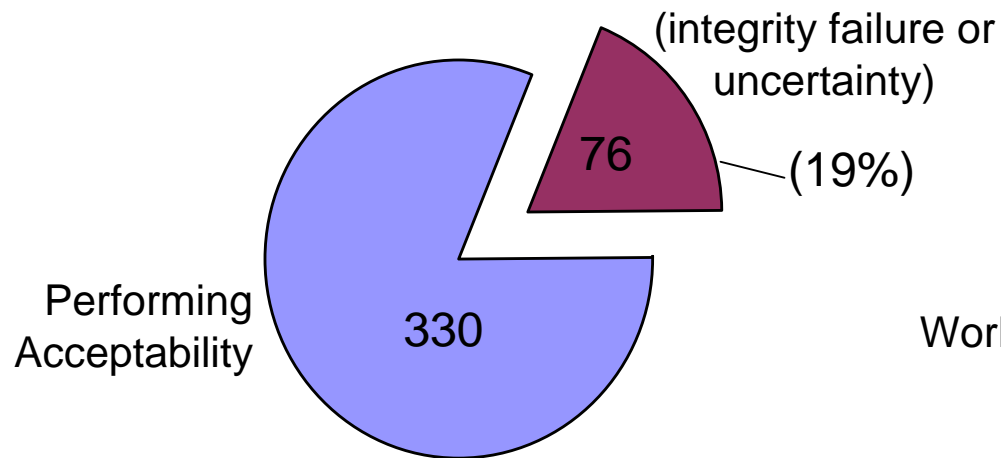


Part 3 - Well Integrity

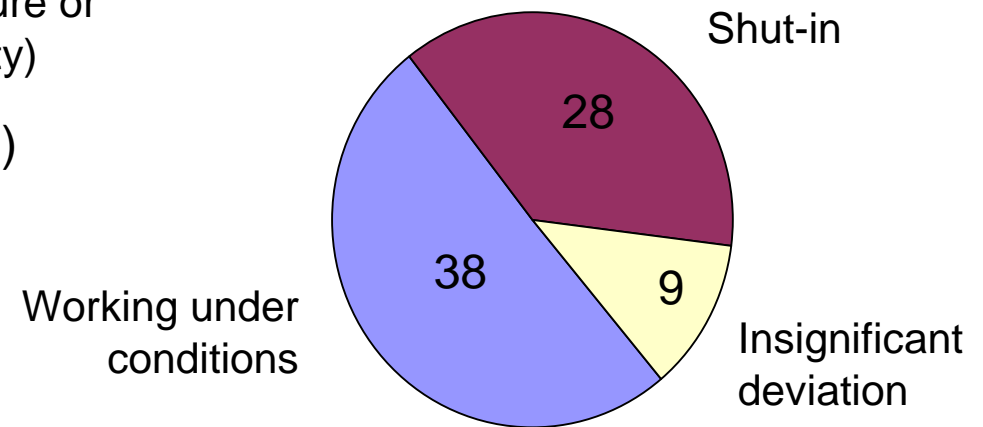


International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Well Integrity Norwegian Study, 2006



406 Wells Surveyed
300 Platform, 106 Sub-sea



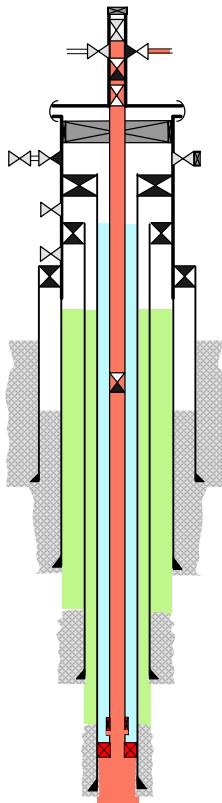
76 Wells With Integrity
Failure or Uncertainty



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Response to Leaks

Best practices....



- Well data kept complete and current
- All leaks investigated and risked
- Implement necessary mitigation measures
- For annular leaks, integrity of next casing string checked
- Well data (including risk level) updated when leak detected
- Update of operational procedures



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Well Integrity

Well Risk Categorization

Level	Description	Risk Assessment
1	No downhole leak	Acceptable
2	Marginally degraded well Increase in risk	Acceptable; only if risk factors can be controlled
3	Severely degraded well Unacceptable risk	Not acceptable



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Operations personnel must have a clear indication of well barrier status at all times

Learning Points

Increased focus required on well integrity issues, including:

- Competency assurance
- Acceptable tolerances and safety factors in design
- Safety in use of leading edge technology
- Maintaining compliance with planned drilling and work-over programs
- General adherence to 2 barrier philosophy
- Verification and condition monitoring
- Adequate maintenance
- Quality and management of well integrity data

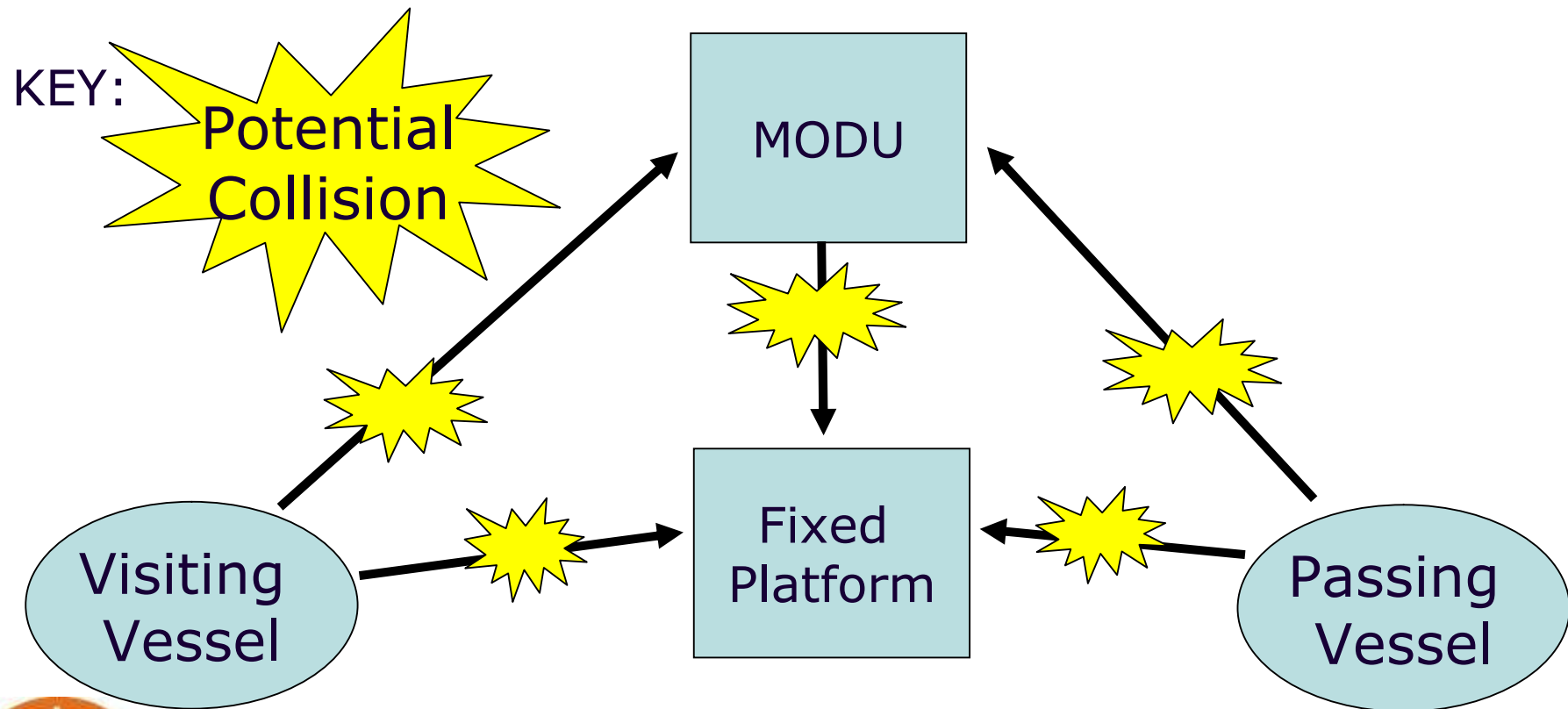


Part 4 - Vessel / Platform / Rig Interactions



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Types of units and possible interactions



Some Recent Examples: Platform / Visiting Boat Collision



- India / July 2005
- Bombay High North platform offshore Mumbai
- Drill rig NCY was also on location
- Platform was struck by a work boat
- Large release / fire
- 22 fatalities
- Major asset loss



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Platform / Passing Vessel Collision



- UK–NS. August 2007
- A passing vessel struck the unmanned Viking Echo gas platform
- The ship sank
- Platform damage estimated at \$20m
- Sig. loss of revenue
- No loss of life
- Vessel captain jailed for 12 months for being drunk and for entering the 500m zone



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

JU Rig / Platform Collision



- Mexico / October 2007
- Usumacinta JU Rig working over a PEMEX platform.
- Details are to be confirmed, however, it is understood that:
- Heavy weather
- The rig moved and struck the platform
- Gas release / H₂S
- Evacuation / 23 fatalities?



International Regulators' Forum
GLOBAL OFFSHORE SAFETY

Learning Points

- Vessel / Platform / Rig collisions may be rare but they can happen
- Consideration should be given to:
 - Collision avoidance
 - The positioning of risers and their potential for damage.
 - The need for fenders / riser guards
 - ESDV positioning
- The risks associated with collisions and riser damage need to be managed



My Job is Done!

And now over to the Panel



International Regulators' Forum
GLOBAL OFFSHORE SAFETY